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ABSTRACT

This study examined teacher leadership behavior in the high school mathematics classroom according to Kouzes and Posner's conceptual framework of credible, exemplary leadership. Data were gathered from 13 mathematics teachers, and 445 high school mathematics students from two suburban high schools. This study found that students did not perceive their teachers to be credible leaders in the classroom and that higher levels of mathematics anxiety in students were found to be significantly related to two teacher leadership behaviors. There were no significant gender differences found between male and female students' reported mathematics anxiety levels; however, gender differences were found to exist between male and female students' perceptions of their teacher's leadership behavior. (Contains 52 references.) (Author)

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The Relationship Between High School Mathematics Teachers' Leadership Behavior and Students' Mathematics Anxiety

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Abstract

This study examined teacher leadership behavior in the high school mathematics classroom according to Kouzes and Posner's (1993, 1995) conceptual framework of credible, exemplary leadership. Data were gathered from 13 mathematics teachers, and 445 high school mathematics students from two suburban high schools. This study found that students did not perceive their teachers to be credible leaders in the classroom and that higher levels of mathematics anxiety in students were found to be significantly related to two teacher leadership behaviors. There were no significant gender differences found between male and female students' reported mathematics anxiety levels. However, gender differences were found to exist between male and female students' perceptions of their teacher's leadership behavior.

The Relationship Between High School Mathematics Teachers' Leadership Behavior and Students' Mathematics Anxiety

Many factors have been found to influence mathematics achievement at the secondary level. In the February, 1995 Research and Development Report, the Office of Educational Research and Improvement reported that students' attitudes toward mathematics decline steadily from the fourth to tenth grade, across all racial and ethnic groups. Although reasons for this decline are unknown, the report suggests that contributing factors may include the quality of teaching, the curriculum, the complexity of the subject, and the cumulative experience of the students.

Studies of secondary level mathematics students have linked classroom environment, gender, students' self-perceptions, parental attitudes, and mathematics anxiety to students' achievement in mathematics. Hembree (1990) found that mathematics anxiety was related to mathematics avoidance behaviors in students and that high mathematics anxiety tended to depress performance in mathematics. Since mathematics anxiety was found to have a negative relationship with students' performance in mathematics, it was important to examine the relationship between students' mathematics anxiety levels in the classroom and their perceptions of their teacher's leadership behavior. Prior to this study, the role of the teacher as the leader in the classroom had not been examined as a possible influence upon students' mathematics anxiety in the classroom.

Meece, Wigfield, and Eccles (1990) found that students who assigned more importance to mathematics achievement and more positive performance expectancies about mathematics reported lower levels of mathematics anxiety in the classroom. Since students who valued mathematics and had more positive expectancies toward mathematics reported lower levels of anxiety, Meece et al. (1990) suggested that future research give attention to the influence that teachers can have upon students' perceptions of mathematics. In order to gain a better understanding of the influence that the teacher has

upon students in the mathematics classroom, this study examined the relationship between students' perceptions of their teacher's leadership behavior in the classroom and their reported mathematics anxiety levels.

Kouzes and Posner's (1995) Leadership Theory suggests that exemplary leaders are ones who are perceived to be credible by their constituents. They describe five behaviors that have been identified as the key leadership practices that exemplary leaders engage in. The credibility of a leader is sustained through a leader's actions or behaviors. They include: (a) challenging the process, (b) inspiring a shared vision, (c) enabling others to act, (d) modeling the way, and (e) encouraging the heart.

This study examined students' perceptions of their teacher's leadership behavior in the classroom, teachers' self-perceptions, and the relationship between the teachers' and students' perceptions according to Kouzes and Posner's (1993) Credibility Theory. Furthermore, Kouzes and Posner's (1993) conceptual framework for credible leadership was used to examine students' mathematics anxiety to determine whether teachers who were perceived to engage in credible leadership behaviors had students who reported lower levels of mathematics anxiety in the classroom.

The purpose of this study was two-fold: (1) to examine the extent to which students perceive their teachers to be credible leaders in the classroom, according to Kouzes and Posner's conceptual framework of credible leadership; and (2) to determine the extent to which variations in students' reported mathematics anxiety levels are related to students' perceptions of their teacher's leadership practices in the high school mathematics classroom. The research questions were:

1. To what extent do selected mathematics teachers establish credible relationships with their students, as defined by Kouzes and Posner's credibility theory?

   1A: To what extent do selected mathematics teachers' self-perceptions of their leadership behaviors reflect the leadership practices of Kouzes and Posner?

1B: To what extent do the students' perceptions of their teacher's leadership behaviors reflect the leadership practices of Kouzes and Posner?

1C: To what extent are mathematics teachers' self-perception of their leadership behaviors congruent with students' perceptions of their teacher's leadership behaviors?

2. To what extent are variations in students' mathematics anxiety levels related to students' perceptions of their teacher's credibility as a leader?

This study was designed to provide insight into the relationship between students and teachers in the mathematics classroom. By understanding the congruence or lack of congruence between students' and teachers' perceptions in the classroom, relationships within the classroom can be improved. In addition, this study was designed to examine students' perceptions of their teacher's leadership behavior in the classroom to determine whether certain teacher behaviors were associated with greater mathematics anxiety in the classroom. An understanding of the teacher behaviors that create or reduce mathematics anxiety in the classroom can be utilized by teachers to improve the interactions that take within their mathematics classroom.

Method

Case Study Design

A multiple site embedded case study methodology was chosen for this study to examine the extent to which teachers as leaders in the mathematics classroom establish credible relationships with their students. Yin (1994) states that "...the case study is preferred in examining contemporary events, ... when relevant behaviors cannot be manipulated" (Yin, 1994, p. 8). Since the purpose of this study was to examine the extent to which teachers establish credible relationships with their students in the mathematics classroom, the "relevant behaviors" for this study, the relationships between students and teachers, could not be manipulated. Thus, the case study design was appropriate.

A multiple site case study design was used because the relationships between teachers and students needed to be studied together in the context of a high school mathematics classroom. Two public school systems were used as the sites for this case study and they were coded and referred to throughout the study as Hamilton and Troy, respectively. The main unit of analysis for each school in this study was the mathematics classroom. However, since selected ninth, tenth and eleventh grade mathematics classrooms within the high school were subunits of the total number of classrooms in the high school mathematics department, an embedded multiple site case study design was used. Yin (1994) states that when a case study may involve more than one unit of analysis within a case, an embedded case study design would be used. A listing of the subunits that were analyzed are included in Table 1.

Procedure

Instrumentation

Data were gathered using two formal testing instruments, Kouzes and Posner's (1993) Leadership Practices Inventory and Suinn's (1988) Mathematics Anxiety Rating Scale for Adolescents. An informal instrument, the Teacher Information Form, was developed by the researcher to collect open-ended responses from teachers. The Leadership Practices Inventory consists of two forms: the LPI-Self Form that the teacher as the leader in the classroom fills out, and the LPI-Observer Form which is filled out by the constituents (the students). The analysis of the data involved the scoring of the LPI and the scoring of the Mathematics Anxiety Rating Scale. The instruments were scored according to the instructions contained in Kouzes and Posner's (1993) LPI Self-Assessment and Analysis and in Suinn's (1979) Information for Users, respectively.

Data Analysis

The Leadership Practices Inventory Observer scores contain information about students' perceptions of their teacher's credibility as a leader in terms of the five key leadership practices. The mean LPI-Observer scores for each of the five leadership

practices were calculated for each teacher. Each teacher, as the leader in the classroom, received a mean constituent score for each of the five leadership practices: (a) challenging the process, (b) inspiring a shared vision, (c) enabling others to act, (d) modeling the way, and (e) encouraging the heart. These mean scores were converted to percentile scores and categorized as low, moderate, or high according to the LPI scoring guide. According to Kouzes and Posner (1993), a "high" score for a leadership practice is one that falls at or above the seventieth percentile, while a "low" score is one that falls at or below the thirtieth percentile. A "moderate" score is one that falls between the thirtieth and the seventieth percentile. According to Kouzes and Posner (1993), high scores on the LPI-Observer indicate that the leader is perceived as having a high degree of personal credibility. Low scores on the LPI-Observer indicate the areas in which there are opportunities for growth for the leader. For each leader, each of the five leadership practices are given a separate mean LPI-Observer score so that specific information regarding the extent to which leaders engage in the five leadership practices can be examined. The procedure outlined in Kouzes and Posner's (1993) scoring guide was followed for the analysis of the scores on the LPI-Observer and the LPI-Self Form.

The LPI-Self provides a score for each of the five leadership practices that is determined by teachers' responses to a self-rating scale. The teachers' self rating scores were converted to percentile scores and categorized as low, moderate, or high according to the LPI scoring guide. The conversion of LPI scores to percentile scores followed the scoring procedure outlined in Kouzes and Posner's (1993) scoring guide. To gain additional information regarding teachers as leaders in the classroom and their relationship to students, responses to the Teacher Information Form were collected. The Teacher Information Form consisted of four open-ended questions that teachers responded to regarding their perceptions in the classroom. The first three responses to the open-ended questions on the Teacher Information Form provided insight into the extent to which teachers establish credible relationships with their students as determined by the behaviors

and strategies that teachers exhibit in class. Responses to the fourth open-ended question provided additional information regarding Research Question Two, which addresses the relationship between students' mathematics anxiety levels and their perceptions of their teacher's credibility as a leader. A copy of the Teacher Information Form is included in the appendix.

To determine the extent to which teachers' self-perceptions of their leadership behavior were congruent to their students' perceptions of their teacher's behaviors, the Mann-Whitney U-Wilcoxon Rank Sum W Test was used. Students' mean LPI-Observer scores for each leadership behavior were compared to their respective teacher's LPI-Self scores to determine whether a statistically significant difference existed. Since the Mann-Whitney U-Wilcoxon Rank Sum W Test does not require assumptions about the shape of the underlying distribution of the data, its use is appropriate.

To determine the extent to which variations in students' mathematics anxiety levels were related to students' perceptions of their teacher's credibility as a leader, mathematics anxiety scores and LPI-Observer scores were compared for each classroom in two ways: (1) students' mean mathematics anxiety scores were compared to each of the five mean LPI students' scores, and (2) the mathematics anxiety percentile scores were compared to each of the five leadership behavior percentile scores. The data were analyzed using both the mean scores and the percentile scores to insure that the resulting relationships that were determined were consistent. The Spearman rank correlation coefficient was used to determine whether a significant relationship existed between mathematics anxiety and students' perceptions of their teachers' leadership behavior.

Participants

The first site in this study was the Hamilton High School mathematics department. Six ninth grade and six tenth grade mathematics classrooms were included in the study. The sample selected included two basic/remedial level mathematics classrooms, two

regular grade level mathematics classrooms, and two honors level mathematics classroom for the ninth and tenth grade. The criteria used for selecting the sample of classrooms were determined by the teacher's years of experience and the level of the courses. Ninth and tenth grade mathematics teachers with more than three years of teaching experience were used in this sample. All levels of mathematics instruction were included. For the Hamilton High School sample of mathematics classrooms, a total of eight teachers and twelve mathematics classrooms (two hundred and twenty-nine students) were surveyed.

The second site in this study was the Troy High School mathematics department. Six ninth grade, three tenth grade, and two eleventh grade mathematics classrooms were included in the study. The sample of mathematics classrooms from the Troy school district had course curriculums that were comparable to the course curriculums of the mathematics classrooms selected from the Hamilton school district. The course levels from the Troy sample of mathematics classrooms include two basic/remedial, two regular level, and two honors ninth grade classrooms, one regular and two honors tenth grade classrooms, and two basic/remedial eleventh grade classrooms. For the Troy High School sample of mathematics classrooms, a total of five teachers and eleven mathematics classrooms (two hundred and sixteen students) were surveyed.

Results

Research Question 1A

Teachers' responses on the LPI-Self indicated that teachers perceived themselves to be effective leaders in the classroom. Teachers' perceptions of their credibility as a leader, as defined by Kouzes and Posner's (1995) conceptual framework for exemplary leadership, indicate that teachers consistently considered themselves to be within the moderate to high range for each of the five leadership behaviors. The specific percentage of teachers that perceived themselves to be low, moderate, and high for each of the five leadership behaviors are presented in Table 2.

Teacher efficacy involves the extent to which teachers believe they can influence student learning and bring about positive student change (Gibson & Dembo, 1984). The teachers participating in this study indicated that they perceived themselves to be credible, effective leaders in the classroom. All of the teachers surveyed considered themselves to be in the moderate to high category for the leadership behaviors of modeling and encouraging. The percentage of teachers that considered themselves to be challenging, inspiring, and enabling in the classroom was evenly dispersed across the three categories of low, moderate, or high. However, overall 69.23% of the teachers considered themselves to be moderate to high for the leadership behaviors of challenging and inspiring, and 61.54% of the teachers considered themselves to be moderate to high for the leadership behavior of enabling. The teacher responses to the Teacher Information Form provided additional evidence regarding the teachers' leadership behavior in the classroom. These responses supported the teachers' reported LPI-Self percentile scores. The teachers' LPI-Self percentile scores and their responses to the Teacher Information Form indicate that teachers perceived themselves to be credible leaders who engaged in the five leadership practices of exemplary leadership in the mathematics classroom.

The literature on teacher efficacy indicates that higher teacher efficacy is associated with higher student cognitive achievement in mathematics. Teachers with higher efficacy may be more willing to try new teaching techniques (challenging the process), may have more positive attitudes toward low achievers than low efficacy teachers (encouraging the heart), and tend to foster student development (enabling others to act) (Ross, 1994). Kouzes and Posner's (1993) five leadership behaviors are similar to the behaviors found in Ross' (1994) research on teacher efficacy. Although teacher efficacy was not measured in this study, teachers' responses on the LPI-Self indicated that teachers perceived themselves to be effective, credible leaders in the classroom, who challenge, inspire, enable, model, and encourage their students in the mathematics classroom. The teachers who participated in this study indicated their high teacher

efficacy through their responses to the LPI-Self and their responses to the Teacher Information Form. According to the review of the research on teacher efficacy and teacher leadership, teachers engaging in the five key leadership behaviors should bring about positive student change. The relationship between the five leadership behaviors and students mathematics anxiety levels are examined in response to Research Question 2.

Research Question 1 B

The mean scores of students' perceptions of their teacher's leadership behavior for each teacher were converted to percentiles and categorized as low, moderate, or high. Students' mean responses to the LPI-Observer indicated that 100% of the students perceived their teachers to be in the low to moderate range for each of the five leadership behaviors. For the leadership behaviors of challenging, inspiring, and enabling, the majority of the mean percentile LPI-Observer scores indicated that students perceived their teachers to be in the low range, while the majority of the students perceived their teachers to be in the moderate range for the leadership behaviors of modeling and encouraging. The specific percentage of students' perceiving their teachers to be in the low, moderate, and high category for each of the five leadership behaviors are presented in Table 3.

For all five leadership behaviors, the mean student LPI-Observer scores indicated that students perceived their teachers to be in the low to moderate range. None of the teachers were perceived by their students to be in the high range for these leadership behaviors. However, for two leadership behaviors, modeling and encouraging, the majority of the teachers were perceived to be in the moderate range. Kouzes and Posner's (1993) scoring guide for the LPI-Self and Observer requires that each leadership behavior receive a separate score. Thus, a low score for one or more leadership behavior would suggest the areas upon which there are opportunities for growth for the leader. Students' LPI-Observer scores indicated that students perceived their teachers to be low for three of the five leadership behaviors, challenging, inspiring, and enabling. These three leadership

behaviors are representative of the areas upon which there are opportunities for development for the teacher leaders in the classroom.

By applying Kouzes and Posner's (1993, 1995) Credibility Theory and Leadership Framework to the classroom, an exemplary, credible teacher is one who challenges, inspires, enables, models, and encourages the students. Students' responses to the LPI-Observer indicated that they did not perceive that their teachers engage to a high extent in the five leadership practices for exemplary leadership in the classroom. One hundred percent of the students' mean LPI-Observer scores were in the low to moderate categories for the five leadership behaviors.

Research Question 1C

A comparison between teachers' overall mean LPI-Self percentile scores and students' overall mean LPI-Observer percentile score indicates that teachers' self-perceptions and students' perceptions of their teacher's leadership behavior for all five leadership behaviors were not congruent. Teachers perceive themselves to be credible leaders who engage in the five leadership behaviors in the classroom to a higher degree than is indicated by their students.

Kouzes and Posner (1993) indicate that leaders are more likely to be perceived as effective leaders with a high degree of personal credibility when their LPI-Observer scores are high. In addition, they state that higher LPI-Observer scores are associated with higher commitment and greater satisfaction among constituents with their leader's strategies and practices. Teachers and students differ significantly in their perceptions. Specifically, teachers perceived themselves to be significantly higher on the LPI-Self for all five leadership behaviors when compared with their respective students' LPI-Observer scores. Therefore, although teachers perceive themselves to be credible leaders in the classroom, as defined by Kouzes and Posner's (1993) five leadership behaviors, their students do not perceive their mathematics teachers to be credible leaders in the classroom.

Research Question 2

Variations in students' mathematics anxiety levels were found to be related to two of Kouzes and Posner's (1993) five leadership behaviors for credible leaders. The leadership behaviors of challenging the process and inspiring a shared vision, as perceived by the students, were positively and significantly correlated with students' mathematics anxiety levels. Thus, students who perceived their teachers to challenge the process and inspire a shared vision in the classroom were more likely to report higher levels of mathematics anxiety. Students' perceptions of their teacher's leadership behaviors of modeling the way, encouraging the heart, and enabling others to act was not found to be significantly related to students' reported mathematics anxiety in the classroom. The relationship between students' mathematics anxiety levels and students' perceptions of their teacher's leadership behavior are presented in Table 4.

The Leadership Practices Inventory (LPI) identifies five of the key leadership behaviors that are exhibited by exemplary leaders when they are at their personal best. According to Kouzes and Posner (1993), leadership is defined as the "art of mobilizing others to want to struggle for shared aspirations" (p. 30). Leaders who engage in the five leadership practices and are perceived by their constituents to be credible leaders mobilize their constituents to become internally motivated and strengthen their inner desire. The results of this study indicate that teachers, as leaders in the classroom, are not perceived to be credible leaders by their student constituents. Furthermore, students who perceived their teachers to engage in the leadership behaviors of challenging and inspiring were more likely to report higher levels of mathematics anxiety in the classroom. This finding suggests that there is a significant relationship between students' perceptions of their teacher's leadership behavior and students' reported anxiety levels. Whereas, Kouzes and Posner's (1995) conceptual framework for exemplary leadership describe the five leadership behaviors as key behaviors for successful leadership, students' perceptions of

their teachers as leaders for two of these behaviors were found to be related to higher levels of mathematics anxiety in the classroom.

Teacher Attributions For Students' Anxiety

Teachers identified influences external to their own behavior as contributing to students' mathematics anxiety in the high school classroom. Teachers' responses to Question Four on the Teacher Information Form provided supplementary information regarding the characteristics that teachers felt contributed to mathematics anxiety in students. There were a total of twenty-nine characteristics listed by the thirteen teachers in response to Question Four. Question Four asked teachers to provide examples of the characteristics that they felt contributed to mathematics anxiety in high school students. These responses were coded and the examples that teachers reported were compared for similarities and grouped together under categories. Three categories emerged for the characteristics that teachers identified as contributing to students' mathematics anxiety in the classroom. Teachers' responses regarding the characteristics that they felt contributed to students' mathematics anxiety in the classroom were grouped into one of three categories: (a) curricula issues, (b) student characteristics, and (c) instructional strategies.

Thirteen of the twenty-nine characteristics identified through data analysis of the thirteen teachers' responses to Question Four involved curricula issues. Some examples of teachers' responses regarding the characteristics that contribute to mathematics anxiety in students included poor textbooks, problems that are too difficult for students, a disruptive classroom environment, and a curriculum that lacks the connections of mathematics to students' lives.

Eleven of the teachers' responses identified students' personal characteristics as contributing to students' mathematics anxiety in the classroom. Some examples of the teachers' responses regarding the characteristics that they felt contributed to students' mathematics anxiety in the classroom included students' self esteem, low confidence, fear of failure, parental and peer pressure, and previous negative experiences in mathematics.

Five of the twenty-nine teacher responses identified instructional strategies that reflected teacher behaviors in the classroom as contributing to mathematics anxiety in high school students. Some examples of the teacher related behaviors that were identified as contributing to mathematics anxiety in students included a lack of teacher patience, teachers who talk at kids, teachers who are too strict, and teachers who make fun of students.

The teachers perceived mathematics anxiety to be related to a number of characteristics external to their own behavior in the classroom. The majority of the teachers' responses, or twenty-four of the twenty-nine characteristics identified by teachers indicated that curricula issues and students' personal characteristics contributed to mathematics anxiety in high school students. Only five of the teachers' responses identified teacher related behaviors as contributing to mathematics anxiety in students. The qualitative information provided by teachers' responses to the Teacher Information Form indicated that teachers attributed students' mathematics anxiety primarily to influences external to their own behavior in the classroom.

Gender Differences

In order to investigate whether significant gender differences existed between male and female students' perceptions of their teacher's leadership behaviors and students' reported mathematics anxiety score, the Mann -Whitney U -Wilcoxon Rank Sum W Test was used. The Mann-Whitney U-Wilcoxon Rank Sum W Test was conducted to determine whether significant gender differences existed. Male and female students' perceptions on the LPI-Observer and on the MARS-A were compared to determine whether significant gender differences existed. The results of the Mann-Whitney U-Wilcoxon Rank Sum W Test are displayed in Table 5.

There were statistically significant gender differences between male and female perceptions of their teacher's leadership behavior of modeling the way in the classroom. Female students perceived their teachers to engage in modeling behaviors in the classroom

to a significantly higher degree ($p<.05$) when compared to the male students. In addition, female students perceived their teachers to engage in the leadership behavior of encouraging the heart in the classroom to a significantly higher degree ($p<.05$) when compared to the male students.

The Mann-Whitney U-Wilcoxon Rank Sum W Test was used to determine whether significant differences existed between male and female mathematics anxiety scores. For the sample of female students (n=247), the mean mathematics anxiety score was 197.46. For the sample of male students (n =198), the mean mathematics anxiety score was 206.4. On average, the males reported mathematics anxiety scores that were higher than the mathematics anxiety scores reported by females. However, these differences were not statistically significant.

Discussion and Conclusions

This study contributed to the literature base on effective teaching by applying Kouzes and Posner's (1993, 1995) conceptual framework of credible leadership and their model of the five fundamental practices of exemplary leadership to the classroom. Brown-Provost (1995) examined informal teacher leadership using this framework and found that teachers, as informal leaders in schools, develop credible relationships with each other. Furthermore, Brown-Provost (1995) found that Kouzes and Posner's (1993) Credibility Theory served as an authentic descriptor of informal teacher leadership behaviors in the school setting. However, Kouzes and Posner's (1993,1995) conceptual framework of credible leadership had not been applied to describing the teacher's role as a leader in the classroom. This study was the first study to apply Kouzes and Posner's (1993, 1995) credible leadership framework to the classroom setting. The underlying premise of this study concerns teacher leadership and students' achievement in the

classroom. If students are to be successful in the mathematics classroom, then the teacher as a leader in the classroom should develop credible relationships with the students. This study explored the relationship that exists between the students and their respective teachers and focused upon how teacher leadership behaviors relate to students' reported mathematics anxiety.

Teacher efficacy involves the extent to which teachers believe they can influence student learning and bring about student change (Gibson & Dembo, 1984). Teachers with high efficacy have been found to be open to new ideas, have more positive attitudes toward low achievers than low efficacy teachers, and foster student development (Ross, 1994). Although teacher efficacy was not a direct focus of this study, the teachers participating in this study perceived themselves to be highly credible leaders in the mathematics classroom. Teachers who engage in the five fundamental leadership behaviors from Kouzes and Posner's (1995) leadership framework can bring about positive student change through their ability to challenge their students to new ideas, through their positive and encouraging attitudes toward their students, and through their ability to foster their students' development by enabling them to act.

As the leader in the classroom, the teacher plays an important role in determining the types of interactions that take place within the classroom environment. Since the teachers perceived themselves to be highly credible leaders in the mathematics classroom, these teachers have a positive sense of self efficacy regarding their leadership behavior in the classroom. The research on teacher efficacy emphasizes the positive influence that high teacher efficacy can have upon students in the classroom (Ross, 1994). However, teachers' self-perceptions do not provide insight into how their constituents perceive them to be as leaders in the classroom.

In order for teachers to develop a strong, credible relationship with their students, it is important for them to consider and become aware of the perceptions of their students. Since previous research has found that students who had teachers with a more positive

sense of teacher efficacy believed that they were performing better in mathematics (Midgley et al., 1989), the effects of teachers' self-perceptions on the LPI in relation to students' achievement should be investigated.

Implications for Teacher Leadership

This study examined students' perceptions of their teacher's leadership behavior in the classroom. Students' responses to the LPI-Observer indicated that students did not consider that their teachers engage in challenging, inspiring, enabling, modeling, and encouraging behaviors in the classroom. They did not perceive their teachers to be credible leaders in the classroom, as defined by Kouzes and Posner's leadership practices.

Kouzes and Posner's (1995) research indicates that people who perceive their managers to have low credibility are significantly more likely to "...produce only if they're watched carefully, consider looking for another job if the organization experiences problems, feel unsupported and unappreciated, and say good things about the organization publicly but criticize it privately" (p. 27). Since participating students perceived their teachers to have low credibility, the results of Kouzes and Posner's (1995) leadership research have implications for how teachers organize instruction within the mathematics classroom.

If Kouzes and Posner's (1995) research on leadership credibility is applied to the classroom, then student constituents who perceive their teachers to have low credibility may only work when the teacher "watches them", they may look for another "job" by enrolling in non-mathematics courses, and their teachers may not be aware of their students' perceptions of the classroom because students may criticize the classroom privately. Kouzes and Posner (1995) suggest that a constituent's loyalty, commitment, energy, and productivity depends upon how a constituent perceives the leader. Since the students in this study perceived their teachers to have low credibility, their productivity, commitment, and energy towards their learning of mathematics may be jeopardized.

Kouzes and Posner (1995) describe leadership as "...the art of mobilizing others to want to struggle for shared aspirations" (p. 30). Leaders who engage in the five leadership practices are leaders who "manage" their credibility. That is, they mobilize others to want to act because of the credibility they have earned in the eyes of their constituents. Since teachers are not perceived by their students to be credible leaders in the classroom, students' motivation to learn mathematics may be effected. Due to the lack of credibility that teachers have earned in the eyes of their student constituents, students may not be "mobilized" by their teachers to "want to act" or in this case, learn high school mathematics.

Teacher Leadership and Gender Differences

Gender differences were found to exist between male and female students' perceptions of their teacher's leadership behaviors of encouraging the heart and modeling the way. For this study, female student constituents reported that their teachers engaged in the leadership behaviors of encouraging the heart and modeling the way to a significantly higher degree than did the male student constituents. Male and female students differed in their perceptions of their teacher's leadership behaviors. A teacher who encourages the heart would be one who recognizes the contributions of the students and celebrates their accomplishments. A teacher who models the way would be a teacher who sets an example for their students and makes it easier for their students to achieve their goals. Female students perceived that their teachers engaged in these two leadership behaviors to a significantly higher degree when compared to the perceptions of the male students.

One possible reason for the difference in perceptions may be due to the gender of the teachers participating in the study. There were ten female teachers and three male teachers who participated in this study. It is possible that these gender differences in students' perceptions may be related to the high number of female students who reported their perceptions of their female teacher leaders. Female students may perceive their

female teachers to engage in more encouraging and modeling behaviors simply because they identify with their teacher leader's shared gender.

Gender Differences and Mathematics Anxiety

Hembree's (1990) meta-analysis of research involving mathematics anxiety suggests that across all levels, female students report higher levels of mathematics anxiety than males. This study did not find that there were significant gender differences in students' reported mathematics anxiety levels. One possible reason for the lack of significant gender differences in the mathematics anxiety levels of the students may be due to the gender of the teachers participating in this study. There were more female mathematics teachers than there were male mathematics teachers participating in this study. This may have had an influence upon students' reported mathematics anxiety levels. Whereas previous research indicates that female students report higher levels of mathematics anxiety than male students, the lack of significant gender differences in this study may have been influenced by the gender of the teacher. The previous research on mathematics anxiety and gender differences may have been conducted at a time when there were fewer female mathematics teachers. The gender of the teacher may play a role in students' reported mathematics anxiety levels. Female students in this study, on average, reported lower levels of mathematics anxiety when compared to the average for male students. However, for the sample of students (n=445) participating in this study, gender differences were not found to be statistically significant for students' reported mathematics anxiety.

Implications for Student Achievement

Kouzes and Posner's (1993) research indicates that when comparing leaders' self-perceptions with the perceptions of their constituents, the leaders have a tendency to report themselves as engaging in exemplary leadership behaviors to a somewhat higher degree. However, this study found that teachers' and students' perceptions differed for all

five leadership behaviors and that there was no agreement between teachers' and students' perception of the credibility of the teacher as a leader in the classroom.

Leaders have a significant impact upon an organization. Teachers, as leaders in the classroom, can contribute to the classroom environment in both a positive and negative manner. Since the results of this study demonstrated that teachers and students differed significantly in their perceptions of the teacher's credibility as a leader and since students did not perceive that their teachers demonstrated credible leadership behaviors, this may have implications for students' academic mathematics achievement.

In the mathematics classroom, the teacher can have a significant impact upon the performance of the students. Kouzes and Posner (1995) found that leaders who engage in the five fundamental practices of leadership are seen by their constituents as more effective in meeting job-related demands, as responsible for creating higher performing teams, and are leaders who increase constituents' motivational levels and the willingness to work hard (p. 320). If leadership can foster improved performance in constituents within an organization by increasing their motivation and their willingness to work hard, then the teacher, as a leader in the classroom, can account for improved performance in students by engaging in Kouzes and Posner's (1995) five key leadership behaviors.

Teacher Leadership and Mathematics Anxiety

Contrary to the researcher's expectations, two of Kouzes and Posner's (1993) five leadership practices, challenging the process and inspiring a shared vision, were related significantly to higher levels of mathematics anxiety in students. The other three leadership behaviors, modeling the way, enabling others to act, and encouraging the heart, had no significant relationship with students' reported mathematics anxiety levels.

Higher levels of mathematics anxiety have been found to be related to lower levels of student performance in mathematics (Hembree, 1990). Since mathematics anxiety has been found to influence students' performance in mathematics, it was expected that higher LPI-Observer scores would be associated with lower levels of mathematics anxiety.

It was the researcher's expectation that teachers who exhibited credible leadership behaviors in the classroom, as measured by the LPI-Observer, would have students who reported that they have lower levels of mathematics anxiety in the classroom. However, this study found evidence to the contrary. Teachers who were perceived as challenging and inspiring in the classroom, as measured by students' responses on the LPI-Observer, had students who reported higher levels of mathematics anxiety in the classroom.

Teachers who challenge the process in the classroom are teachers who are willing to innovate, experiment, and view mistakes as learning experiences. Challenging the process is one of the five fundamental leadership behaviors described by Kouzes and Posner (1995) as contributing to credible leadership.

One possible reason for the relationship between challenging teacher behaviors and an increase in students' reported mathematics anxiety could be due to the balance between a teacher's ability to challenge the students and the students' ability in mathematics. If a teacher challenges students without first recognizing what students are capable of, anxiety could be heightened. In addition, if a teacher does not have a good rapport or a positive, credible relationship with the students in the classroom, then the teacher's challenging behavior may result in higher levels of mathematics anxiety in students.

Inspiring a shared vision involves a teacher's strong belief that they can make a difference by enlisting the support of their students toward a common purpose. Leaders who inspire have a vision of the future and communicate this vision to their constituents. Although inspiring a shared vision is one of Kouzes and Posner's (1995) five fundamental behaviors for exemplary leadership, this study found that there was a significant relationship between teachers who were perceived as engaging in inspiring leadership behaviors in the classroom and an increase in students' reported mathematics anxiety levels.

Students did not perceive their teachers to be credible leaders in the classroom. Therefore, although teachers had positive self-perceptions of their leadership behavior in

the classroom, these perceptions were not congruent with the perceptions of their student constituents. If students do not believe that their teachers are credible leaders in the classroom, then they won't feel excited and enthusiastic about the future goals of the classroom. Kouzes and Posner (1995) state that "...if we don't believe in the messenger, we won't believe in the message" (p. 26). This can ultimately effect students' achievement levels in mathematics.

Teacher leaders must learn how to "manage" their credibility. That is, they must be "...conscious of how their behavior shapes the impressions others have of them ...so they can take charge of how others come to see them" (Kouzes & Posner, 1995, p. 30). According to Kouzes and Posner (1995), effective leaders are constantly learning and since leadership is a set of skills that can be strengthened and enhanced, leaders can improve their ability to have a significant impact upon their constituents. For teachers, this would involve their ability to get involved and stay in touch with the people they lead, their students.

Teachers can earn their credibility as leaders in the classroom through personal contact and by taking the time to listen to their student constituents. Teachers should be seen as approachable leaders in the classroom and should work towards listening to their students, trusting them, and being receptive to their input. In addition, teachers should be aware of their students' perceptions of the extent to which they engage in the five key leadership behaviors so that teachers can strengthen those behaviors and learn new skills. The categories assessed with the LPI-Self and Observer Forms provide feedback for teachers so that they can work to strengthen and practice specific skills related to the five leadership behaviors. Although students did not perceive that their teachers exhibited the five leadership behaviors in the classroom, these perceptions may change over time depending upon the teacher's motivation to receive feedback and modify their behavior in the classroom.

Summary

This study was an exploratory study that related two phenomena that effect students in the mathematics classroom, teacher leadership behavior and mathematics anxiety. Teacher leadership behavior in the high school mathematics classroom was examined according to Kouzes and Posner's (1993, 1995) conceptual framework of credible, exemplary leadership and it was found that students did not perceive their teachers to be credible leaders in the classroom. Furthermore, higher levels of students' mathematics anxiety levels were found to be related to two teacher leadership behaviors, challenging the process and inspiring a shared vision. Since teachers were not perceived to be credible leaders by their student constituents, the relationship between these two leadership behaviors and students' mathematics anxiety levels needs to be explored further.

The lack of credibility that students perceived in their teachers has serious implications for teacher behavior in the classroom. Teachers need to examine their leadership behavior in the classroom in terms of their students' perceptions and work towards minimizing the differences between their self-perceptions and the perceptions of their students. If students are to succeed in the mathematics classroom, then the teachers must be perceived by their students to be credible teacher leaders.

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Appendix

Teacher Information Form

Demographic Information
Teacher Code_____
Level of Education_____
Male or Female_____
Years of Experience_____

1. As a teacher leader in the classroom, please describe the instructional strategies that you feel are the most important or helpful for students who would like to improve their academic performance in mathematics.

1B) What instructional strategies do you feel contribute to a positive classroom learning environment?

2. What teacher behaviors do you believe have a positive effect upon students' perceptions of the high school mathematics classroom? Please give examples.

2B) What teacher behaviors do you believe have a negative effect upon students' perceptions of the high school mathematics classroom? Please give examples.

3. Please describe any instructional strategies that you use in the mathematics classroom that may be different that students have responded to in a positive way.

4. What do you think are two or three characteristics that create or contribute to mathematics anxiety in high school students? Please give examples.

Table 1

Embedded Case Study: Units of Analysis

Main Unit of Analysis:	**Sites**	
The Mathematics Classroom	**Hamilton High School Mathematics Department**	**Troy High School Mathematics Department**
Ninth Grade High School Mathematics Students	1) Basic/Remedial Level 2) Regular Grade Level 3) Honors Level	1) Basic/Remedial Level 2) Regular Grade Level 3) Honors Level
Tenth Grade High School Mathematics Students	1) Basic/Remedial Level 2) Regular Grade Level 3) Honors Level	1) Regular Grade Level 2) Honors Level
Eleventh Grade High School Mathematics Students		1) Remedial Level

Table 2

Teachers' Self-Perceptions on the LPI-Self (N = 13)

Behavior	Low	Moderate	High
Challenge the Process	30.77%	23.08%	46.15%
Inspire a Shared Vision	38.46%	30.77%	38.46%
Enable Others to Act		38.46%	23.08%
Model the Way		23.08%	76.92%
Encourage the Heart		30.77%	69.23%

Note. Percentile scores between 0-29 were categorized as low, scores between 30-69 were categorized as moderate, and scores above 70 were categorized as high.

Table 3

Students' Perceptions of Their Teacher as Measured by the LPI-Observer

Behavior	Low	Moderate	High
Challenge the Process	76.92%	23.08%	
Inspire a Shared Vision	76.92%	23.08%	
Enable Others to Act	84.62%	15.38%	
Model the Way	46.15%	53.85%	
Encourage the Heart	38.46%	61.54%	

Note. n = 13 groups of students

Table 4

Correlation Between Students' LPI-Observer and MARS-A Scores

LPI Leadership Behavior	Correlation to Mean Mathematics Anxiety Rating Scale Score	Correlation to Mathematics Anxiety Rating Scale Percentile Score
Challenge the Process	.4522*	.4361*
Inspire a Shared Vision	.4941*	.4787*
Enable Others to Act	0.2174	0.1026
Model the Way	0.0455	0.0375
Encourage the Heart	0.3142	0.2677

Note. Classrooms ($n = 23$). * $p < .05$.

Table 5

Mann-Whitney U-Wilcoxon Rank Sum W Test for Gender Differences

Leadership Behavior/Mathematics Anxiety	Mann-Whitney U Test Statistic	2-Tailed Significance Level
Challenge the Process	24164	0.8299
Inspire a Shared Vision	23954	0.7108
Enable Others to Act	23305	0.3935
Model the Way	21410.5*	0.0237*
Encourage the Heart	21675.5*	0.0391*
Mathematics Anxiety	23376	0.4244

Note. n(female) = 247. n(male) = 198. *$p < .05$, two-tailed significance level for the obtained value of U.